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ABSTRACT

A project was conducted at the Community College of Luzerne County (Pennsylvania) to develop, in cooperation with area vocational-technical schools, the first year of a competency-based curriculum in computer-integrated manufacturing. Existing programs were reviewed and private sector input was sought in developing the curriculum and identifying needed equipment and facilities. The curriculum developed by the task force is included in this document, presented in three sections. The first section covers general business/industry trends; computer-integrated manufacturing/computer-aided manufacturing technology programs; program competencies; course competencies for technical drafting, manufacturing processes, computer-assisted drafting, and industrial safety; articulation; and a proposed second-year course listing. The second section of the curriculum lists educational specifications for the various courses, and the last section lists equipment specifications. Appendixes to the report list the task force members, describe the literature search, and provide a task listing with manufacturers' ratings of their relative importance. Sample task force letters complete the report. (KC)

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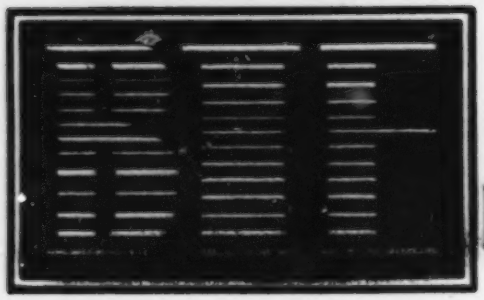
SECTION I

ACKNOWLEDGEMENTS AND ABSTRACT



Business-Industry-Education PARTNERSHIP

ACKNOWLEDGEMENTS

For most of us at the Community College of Luzerne County, this project involved the "breaking of new ground." We have all been involved, more or less, in various phases of curriculum development for several years. However, doing competency-based curriculum development, and doing it in areas that include most of the advanced technologies now being developed, was a difficult and time-consuming task. To be able to do what was done with curriculum development, while at the same time complete the planning for a new advanced technology center (82,000 square feet, $8 million) was an accomplishment that should be recognized. Listed below in alphabetical order are the names of those individuals involved; they are listed with the hope that the work they did will receive more substantial recognition when time and resources permit:

Regina Antonini	Director, Institutional-Based and Community-Based Special Programs and Task Force Coordinator
Elaine Brown	Assistant to the Project Director
Patrick J. Santacroce	Executive Director, Institute for Developmental Educational Activities
Elizabeth Yeager	Research Specialist and Task Force Coordinator
Stephen Yokimishyn	Coordinator, Customized Job Training Programs

A note of thanks also to the consultants Paul L. McQuay and Associates, and Alger, Dowling, and Paullin, and to members of the task force for their effective involvement and contributions.

A special note of thanks to Mr. Thomas J. Moran, President of the Community College of Luzerne County, for his patience, understanding, and flexibility. There were many times when other projects had to be deferred so work on this project could be completed.

Wesley E. Franklin
Project Director and
Director, BIE Partnership, IDEA
September 30, 1987

A B S T R A C T

85-7011: Development of Articulated Competency-Based Curriculum in Computer Integrated Manufacturing

Wesley E. Franklin
Community College of Luzerne County
Prospect St. & Middle Road
Nanticoke, PA 18634

$37,627 Federal
7/1/86 to 6/30/87

The purpose of this project was to develop, in cooperation with area vocational-technical schools, the first year of a competency-based curriculum in computer integrated manufacturing(CIM).

OBJECTIVES

1. Establish a "computer integrated manufacturing" task force comprised of representatives from the community college, participating area vocational-technical schools, and the private sector.

2. Review materials on existing competency-based CIM programs (provided by PDE Resource Center) and identify secondary, post-secondary, and overlapping levels of instruction.

3. Inventory and list existing equipment, facilities, and courses available from all participating institutions related to proposed program.

4. Obtain private sector input on competencies needed by entry-level CIM technicians, and integrate into curriculum materials development activity.

5. Develop rationale/procedures for program articulation between each AVTS and the community college.

6. Develop competency based curriculum materials and review with PDE representatives.

7. Identify equipment and facilities needed to offer articulated programs at AVTS's and community college, with emphasis on non-duplication of high-cost items.

8. Prepare final draft of CBCM and review with deans and directors from each institution.

OUTCOMES

1. Task force was formed, met regularly throughout the year, and provided significant input into curriculum development/articulation process.

2. Curriculum materials and equipment information from other schools was obtained and reviewed; visits were made to two AVTS's and one community college offering similar programs(electro-mechanical).

3. Sample competency lists were developed and mailed to private sector for validation.

4. Consultants were used to develop first-year curriculum and facilities/ equipment specifications.

5. Proposed curriculum and articulation process was reviewed and approved by AVTS directors and community college deans.

AUDIENCE

The resulting report and curriculum materials will be distributed to participating AVTS's, PDE, task force, community college, and private sector.

PUBLISHED MATERIALS--Final Report

SECTION II

NARRATIVE

METHODOLOGY

This curriculum materials development project began with the formation of a task force whose membership included representatives from the four area vocational-technical schools: Hazleton, Lackawanna, West Side and Wilkes-Barre (see ATTACHMENT #1). In the initial grant proposal, the stated plan was to use vo-tech faculty (task force) to assist in curriculum development and in identification of equipment and facilities needed for the program. After several meetings with the task force during the fall semester, this approach did not appear to be feasible because of time and expertise limitations -- most of the members of the task force taught evening courses as well as teaching full-time during the day. Also, because the proposed program is a new technology, there was a significant amount of research that had to be done, both for the college and the task force.

For these reasons, it was decided to use expertise already available, namely consultants, and have the task force function in a review/reaction mode once there were materials/reports from the consultant to consider. This way, the task force's knowledge of the local educational and industrial training requirements could be used to make appropriate changes in the consultant's reports and recommendations so the proposed program would be in line with the needs of the college's service area. Also, representatives of the college's engineering and science departments, administration, and from the private sector were able to participate in the process and provided valuable input throughout.

ATTACHMENT #2 lists the various programs and publications that were reviewed as part of the project's data search. Upon completion of this review, a list of sample competencies was developed and sent to area manufacturers. A copy of the list, showing the summarized competency rankings, is included as

ATTACHMENT #3. As part of this process, the project coordinator and department director, met with a representative from the Pennsylvania Department of Education who reviewed the requirements of the Bureau of Vocational Education for competency-based programs/courses.

Those materials found to be most pertinent, along with the results of the private sector reviews of the sample competencies, were then sent to the consultant as background for the proposed first-year curriculum. Also, one of the results of the task force's review process was the recommendation that the best articulation procedure would be one which provided advanced placement for competencies and/or knowledge rather than attempt to integrate a secondary with a post-secondary curriculum, trying to fit the student in wherever he or she happened to be on the competency continuum. The consultant agreed with this recommendation and included a separate section on articulation in his report. This report is included, in its entirety, under SECTION III.

ANALYSIS/EVALUATION

The proposed first-year program, along with the proposed equipment and facilities plan, were first evaluated by the task force. The task force made several recommendations to the consultants, which were incorporated into the final documents. These documents were then reviewed and approved by the appropriate community college administrators and the directors of the participating AVTS's.

DISSEMINATION

Copies of the final report will be distributed to the following:

Bureau of Vocational and Adult Education, PDE

Area Vocational-Technical Schools

Private Sector participants

Members of Task Force

Consultants

Ben Franklin Partnership

Pennsylvania Economic Development Partnership

Economic Development Council of Northeastern Pennsylvania

Because this is the first year of a two-year project, the final report for the second year will include the complete curricular program, including the associate degree and the certificate of specialization. Upon completion, approximately one year from now, that report will receive more widespread distribution. A listing of courses for the second year is included at the end of the consultant's report for this year.

SECTION III

CONCLUSIONS AND RECOMMENDATIONS

COMPUTER INTEGRATED MANUFACTURING CURRICULUM

(One Year Program of Study)

LUZERNE COUNTY COMMUNITY COLLEGE

Nanticoke, Pennsylvania 18634

June, 1987

COMPUTER INTEGRATED MANUFACTURING/
COMPUTER-AIDED MANUFACTURING
CURRICULUM

General Business/Industrial Trends

The application of Computer-Aided Manufacturing (CAM) has, until recent years, been limited to those companies which have had the capital monies available to invest in a mainframe computer or the operating monies available to purchase shared-time use of mainframe computers.

With the advent of the personal computer (PC), and the computer networking technology associated therewith, as well as the incidental reduction in investment expenses associated with the same, CAM technology is now available for even the smallest business. For example, a small but powerful professional PC can be purchased for about $5,000. Likewise, many reputable basic software computer-aided drafting (CAD) and computer-aided manufacturing (CAM) packages are selling for about $3,000-$5,000. Furthermore, an integrated Computerized Numerical Control (CNC) programming, order service, estimating, and shop scheduling software package may be readily acquired, from several sources, for about $30,000.

Industry forecasters' predictions that more than 65% of the discrete-part manufacturing establishments in the United States would have been applying some form of CAM technology by 1986 have been generally overestimated. However, as a result of competitive pressures, and a general awareness of the capabilities of various software packages, as well as the increased availability of software packages, many more businesses are showing interest. These businesses are finding that they must invest in this technology in an effort to retain and expand their market share. As those businesses and industries adopt the technology, a pressing need for individuals possessing the knowledge and skills required to interface with the new hardware, firmware and software is realized.

An informed technological public is already aware of this need and many individuals are seeking to upgrade their skills to remain current with the technological changes taking place within the work-place. Many others are seeking to change careers and enter this field of manufacturing because of its potential and realized growth. And, others are attempting to gain entry-level skills in an effort to secure a position of employment, expecting to advance with companies adopting and implementing this technology.

In fact, jobs will remain good through the 1990's for the machine tool operator who is skilled in the operation of numerically controlled and automated machine tools. National employment figures in 1984, for the job field of automated tool programmer, were approximately 10,600[1]. And, projections through 1995 call for a 26-37%[1] increase in employment in this job category -- a much faster than the average growth when compared with all the occupations in the nation. Across the state, a 1.4%[1] increase in this job classification is expected for 1987. Prospects for computer-aided drafting and design positions are also excellent. Industry insiders predict that more than 1.2 million[1] new jobs in computer-aided design and computer-aided manufacturing (CAD/CAM), and related service areas, will be created by the year 2000. Educational institutions must adopt appropriate curricula to meet the needs of business and industry, as well as those of individuals seeking to gain knowledge and skills within the various areas of CAM.

[1]Taken from 'VICS-87'.

COMPUTER INTEGRATED MANUFACTURING/
COMPUTER-AIDED MANUFACTURING TECHNOLOGY

Recommended Program of Studies
Leading to the A.A.S. Degree

The Computer-Aided Manufacturing Technology curriculum is designed to provide the student with an introduction to conventional as well as technologically advanced manufacturing processes. The student will become experienced in the use of computers while acquiring a basic understanding of how computer data base information on product specifications can be utilized in the processing of products through automated manufacturing operations. Students will use computers to prepare drawings and document data required for automated production of parts. In addition, the student will become familiar with the use of peripheral equipment, such as plotters and printers, to prepare hard copies of drawings.

First Semester

	Credits	
English Composition I ENG 101	3	
Technical Math I MAT 111 (or higher level substitute).	5	
Technical Drafting with Print Interpretation GET ___	2	(1 hr lec/ 2 hr lab)
Manufacturing Processes Lab I GET ___	3	(2 hr lec/ 2 hr lab)
D.C. and A.C. Fundamentals CEL 101	4	
	17	

Second Semester

Technical Math II	5	
MAT 112 (or higher level substitute)		
Introduction to Computer Programming	3	
Manufacturing Processes Laboratory II	3	(2 hr lect/ 2 hr lab)
GET ___		
Computer Assisted Drafting I	3	(2 hrs lect/ 2 hrs lab)
GET ___		
Industrial Safety	1	
GET ___		
	15	

COMPUTER INTEGRATED MANUFACTURING/
COMPUTER-AIDED MANUFACTURING TECHNOLOGY
PROGRAM COMPETENCIES

Upon successful completion of the program, the student should be able to:

*** apply mathematics to solve technical problems.

*** identify industrial safety standard requirements for the workplace.

*** communicate effectively with co-workers.

*** demonstrate accident prevention practices and procedures while performing basic operations dealing with conventional manufacturing processes such as: inspection, welding, soldering, machine tool operation, sheetmetal forming and fabrication.

*** utilize freehand sketching and mechanical drafting instruments and the techniques of orthographic projection to construct line drawings and create auxiliary and sectional views of objects, as well as interpret mechanical drawings.

*** operate a basic computer system performing such functions as: system start-up, operation, shut-down, and file management.

*** solve technical problems utilizing the basic programming language.

*** perform computerized drafting skills to complete drafting assignments such as: setting-up formats, changing existing drawings, creating and plotting drawings.

*** solve problems using the theories associated with D.C. Electricity.

Course Competencies For:

1. Title: Technical Drafting with Print Interpretation — GET____ — 2 credits
   One Hour Lecture
   Two Hours Laboratory

2. Course Description: This course is designed to provide instruction conducive to the development of knowledge and skills required to complete and interpret mechanical drawings. Likewise, the student will become familiar with symbols and drafting techniques relevant to the interpretation of basic graphs, electrical, electronic and piping diagrams. Upon successful completion of this course, the student should be able to:

3. Course Competencies/Behavioral Objectives

Competency 1: Freehand sketch and, with the aid of mechanical drafting instruments, create drawings representing the shape, size, features and relationships of common objects and interpret same, including:

1.1 demonstrate the techniques of line creation and the aspects of proportionality required to create a freehand sketch.

1.2 identify and demonstrate the use of drafting equipment.

1.3 describe the various elements of a completed drawing, noting the considerations that are necessary for proper planning and layout of a drawing.

1.4 utilize common mechanical instruments to create line drawings.

1.5 interpret basic sketches and drawings.

Competency 2: Apply the rules of drafting and the principles of geometric construction to portray and interpret information regarding manufactured or fabricated objects.

2.1 identify and utilize the American National Standards Institute's standards for line conventions and lettering.

2.2 describe the purpose of each type of line on a drawing and why line weight is important to the viewer.

2.3 demonstrate how to combine geometric elements and construction techniques to describe geometric shapes.

2.4 plan, layout and construct drawings.

2.5 utilize skills and knowledge associated with drafting techniques to interpret drawings.

Competency 3: Utilize the techniques of orthographic projection, multiview, auxiliary, and sectional views to describe and interpret aspects of part shape, size, and configuration, and to clarify part features, including:

3.1 describe the difference between pictorial, multiview, and auxiliary drawings and identify when the use of each is appropriate.

3.2 cite the considerations one should make when selecting views for part-feature representation.

3.3 describe when the use of sectioning, revolution, or break techniques is warranted.

3.4 select appropriate views and complete multiview drawings of objects.

3.5 define terms associated with projection views and demonstrate layout techniques required to complete projections.

3.6 use auxiliary and isometric views of an object to clarify part features and details.

3.7 identify the various types of sectional views and elaborate on the particular circumstances under which each would be used.

Competency 4: Prepare and interpret working drawings with detailed dimensions and notes, applying the American National Standards Institute's (ANSI) rules for symbology for geometric tolerancing, including:

4.1 distinguish between detail and assembly drawings and identify the various types of assembly drawings.

4.2 identify and elaborate on the definition of each of the four basic types of the ANSI geometric tolerancing symbols; namely, geometric characteristic, material condition (modifying), feature control frame, and supplementary symbols.

4.3 identify and elaborate on the definition of each of the five types of the ANSI geometric tolerances; namely, form, profile, orientation, runout and location.

4.4 create detail drawings employing appropriate ANSI geometric tolerancing symbols and descriptions.

4.5 use knowledge and skills associated with the construction of working and detailed drawings to interpret drawings of moderate complexity.

Competency 5: Demonstrate the ability to construct and interpret charts and graphs commonly associated with the processing and manufacturing industries, including:

5.1 construct and utilize common graphs to derive information relevant to the solution of practical problems.

5.2 construct and interpret specific graphs plotted for establishing methods of assuring quality control; namely, Pareto, histogram, normal distribution, scatter diagram, and Average and Range ($\bar{x}$ & R) charts, and attribute control charts.

5.3 derive information from graphs and charts in manufacturer's handbooks and technical manuals.

Competency 6: Identify relevant symbols and interpret schematic diagrams of weldments as well as electrical, electronic and piping systems, including:

6.1 identify various piping symbols in accordance with the ANSI symbol definition.

6.2 identify various electrical symbols in accordance with local and National Electrical Code.

6.3 identify various electronic component symbols and interpret electronic diagrams.

6.4 identify various elements associated with welding symbols -- in accordance with the American Welding Society's symbol standards.

6.5 derive specific information from building riser and wiring prints and schematic diagrams.

Required Course Textbook:

Drafting Technology
Earle, James H., Addison-Wesley

Required Course Workbook:

Drafting Technology Problems
Earle, James H., Creative Publishing

Equipment:

(See attached list) to include -- standard drafting room furnishings.

Recommended Course Instructor's Reference Textbooks (SPC Charts):

Basic Manufacturing Processes
Kazanas, H.C. & others
McGraw-Hill, N.Y.

An Introduction to Basic Statistical Process Control
Garrity, Susan M.
Tech Center Courseware Company

Statistical Process Control -- A Guide for Implementation
Bergo, Roger W. & Hart, Thomas H.
ASQC Quality Press, Milwaukee

Statistical Quality Assurance
Guldner, Francis J.
Delmar, N.Y.

Other:

Delmar Publishers and others series of blueprint reading modules

Various manufacturer's handbooks of tables, charts and manuals

SUGGESTED EQUIPMENT AND SUPPLIES

Required Equipment for Drafting Laboratory Class Work:

- Plastic or Ruby Eraser
- Erasing Shield
- Irregular (French) Curve Set
- 8-Inch 45° Triangle
- 10-Inch $30^{\circ}/60^{\circ}$ Triangle
- 6-Inch Protractor
- Combination Scale, or Architect's and Engineer's Scales
- Metric Scale
- 6-Inch Bow Compass (Large Bow)
- Lead Holder (two recommended) and Lead Pointer (any type)
- Leads: 4H, 2H, H
- Drafting Tape (Masking tape may be used)
- Ames Lettering Instrument
- Pad of Cross-Section Paper, 8-1/2 x 11 inches (1/4" or 1/8" squares)

Optional Equipment:

- Adjustable Triangle
- Dusting Brush
- Gum Bag (dry pad) Cleaner
- Dividers
- Architect's and Engineer's Scales,
- Tracing Paper
- Templates (Circles, Ellipses; Symbols: Welding, Piping, etc.)

Necessary Equipment for Homework and Practice Outside of Laboratory:

- Drawing Board
- T-square

Course Competencies For:

1. Title: Manufacturing Processes Laboratory I GET___ 3 credits
Two Hours Lecture
Two Hours Laboratory

2. Course Description: This course is designed to provide the student with theoretical and selected practical exercises dealing with various manufacturing operations and processes. The degree of exposure to individual operations and processes will range from assigned textbook and reference readings to laboratory exercises. Topics of coverage will include inspection, hot and cold forming, welding, fastening, machining, casting, molding, finishing, assembly, material handling, packaging, process flow, statistical process control, planning, economic justification and related topics. Conventional and newer methods of production will be covered with an emphasis of how computerized equipment can be integrated into the factory environment. Field trips to various industries will supplement instruction.

3. Course Competencies/Behavioral Objectives

Competency 1: Describe the various principles, equipment, operations and materials used to produce cast and molded parts, including:

1.1 determine the classification of casting and molding processes, methods, and materials.

1.2 determine the nomenclature associated with cores, molds, patterns, dies, and the function associated with each.

1.3 determine the procedures involved in the various types of molding processes.

1.4 determine the procedures for melting, pouring and cleaning of cast materials.

Competency 2: Describe, in general terms, the materials forming and removal (machining) processes, including:

2.1 describe the principles of operation for hot, cold and special forming equipment.

2.2 identify the sub-processes and categories comprising the materials forming processes.

2.3 discuss terms such as machinability, chip formation, cutting-tool materials, cutting-tool geometry and coolants.

2.4 describe the basic geometric shapes that can be produced by machine tools and identify the operations/specific machines required to produce a given part feature.

2.5 identify the relatively new category of chipless, special material removal processes.

Competency 3: Describe various fastening, joining and welding processes, including:

3.1 discuss the methods of mechanical fastening, types of fasteners available, and the application for each.

3.2 describe the principles involved with the process of adhesives bonding and the use/dispensing of sealants.

3.3 describe the common types of adhesives available and the limitations associated with each.

3.4 describe the various welding processes and the physical phenomena associated with each.

3.5 describe the inspection and testing techniques commonly associated with welding.

3.6 describe the various solder/brazing processes and discuss related equipment and materials.

3.7 discuss the basic types of joints used in brazing and welding.

Competency 4: Describe the basic principles involved with surface preparation, finishing, painting and plating, including:

4.1 describe the equipment and techniques associated with the in-process cleaning of parts.

4.2 discuss the equipment, processes and techniques associated with part surface coating and finishing.

4.3 identify the reasons for plating a product.

Competency 5: Discuss the aspects of design, planning, common data base creation, sharing of information and organizational structure required for the manufacture/distribution of a product, including:

5.1 discuss, in general terms, the nature, properties and types of materials used in the manufacture of various products.

5.2 describe how modern production methods have evolved with regard to manufacturing systems and automation.

5.3 discuss the concept of product design for ease of manufacture and reduction of costs (in regard to modern production, assembly, materials handling).

Competency 6: Describe the concepts associated with, and the measures taken to perform cost benefit analysis, justification, and quality control assurance in a processing or manufacturing environment, including:

6.1 discuss the fundamentals of investment analysis, identification of types of costs and break-even analysis, and perform a case study.

6.2 describe a general procedure for performing project evaluation and justification.

6.3 describe the role that specifications and standards play in maintaining the quality of products.

6.4 describe the tools/equipment techniques and procedures (with applications), commonly used for inspection purposes and quality control.

6.5 discuss the concepts associated with quality control and assurance techniques.

6.6 discuss the general principles of operation, types of parts capable of being processed, capacities, etc. for various machines/machine tools, packaging, and materials handling equipment found in a modern production environment.

Competency 7: Discuss, in general terms, the various considerations associated with special purpose equipment, mass production, hard and soft automation, assembly techniques, materials handling, storage, and product identification as they relate to the process flow of a product through manufacture, including:

7.1 describe the "special" machinery processes which have evolved over the last forty years.

7.2 describe the terms--primary and secondary operations, and describe the impact of such operations as they relate to the process flow of manufacture and assembly of piece-parts.

7.3 describe the concepts associated with mass production.

7.4 describe the term "dedicated equipment" and give an example of a function that can be performed with such equipment in the manufacture of a part.

7.5 describe the difference between special purpose or dedicated equipment and flexible or reprogrammable equipment.

7.6 describe the role of the control system in automation.

7.7 describe the two basic types of assemblies.

7.8 describe the two methods employed in mechanized assembly of parts.

7.9 describe the concepts involved with designing components for automatic assembly.

Required Coruse Textbook:

Basic Manufacturing Processes
Kazonas, H.C. & others
McGraw-Hill, N.Y.

Recommended Instructor's Reference Textbook:

Materials and Processes in Manufacturing
DeGarmo, E. Paul & others
MacMillan, N.Y.

Course Competencies For:

1. Title: Manufacturing Processes Laboratory II GET___ 3 Credits
Two Hours Lecture
Two Hours Laboratory

2. Course Description: This course is designed as an introduction to cold chip forming processes and will provide the student with a basic theoretical and practical background in machine tool practices. Such experiences are a prerequisite to the pursuit of a course, or courses, in computer-assisted machining. Topics of coverage will include machine tool operations, cutting fluids, carbide tooling, material speeds and feeds, theory of work holding devices, and the theory for calculating tapers and threads.

3. Course Competencies/Behavioral Objectives

Competency 1: Select appropriate precision measuring instruments, or layout tools, and cite the operations required to perform layout and inspection work, including:

1.1 identify the best tool for performing specific inspection and/or layout operations.

1.2 demonstrate the ability to use basic layout and inspection tools.

1.3 develop a generalized set of operational procedures to employ in regard to inspecting a specific product.

1.4 apply basic principles and techniques of measurement to perform inspection procedures on completed and work in-process.

1.5 apply the principles of statistical methods to assure quality.

1.6 outline a procedure to follow in tracing causes of defective work.

1.7 layout workpieces for machining.

Competency 2: Make informed decisions relevant to the selection of carbide cutters/tool holders, cutter and insert geometry, cutting tool material/grade, speeds and feeds for milling and turning operations, including:

2.1 describe how workpiece material, hardness, and geometry affect cutting tool selection.

2.2 identify and elaborate on the design characteristics for the various types of adapters, cutters, drills, tool holders, boring bars and inserts.

2.3 demonstrate the use of vendor's catalogs for selection of cutters, tool holders, inserts, cutting fluids, speeds and feeds.

2.4 perform speed, feed, and horsepower calculations for carbide tooling.

2.5 prepare operation/tooling sheets for various jobs/machines.

Competency 3: Demonstrate the knowledge, skill and accident prevention awareness required to perform job planning, tool selection, machine setup and operations associated with lathes, including:

3.1 perform routine maintenance and lubrication operations on various lathes.

3.2 cite comparative characteristics of cutting tool/piece-part materials, piece-part geometry, tool holder, and work holding devices in a manner conducive to assuring an efficient setup with safe machining conditions.

3.3 identify and set appropriate speed and feed parameters for machining.

3.4 set-up various work holding devices and securely mount the workpiece.

3.5 set-up and operate various types of lathes and perform various operations commonly associated with lathe work.

Competency 4: Demonstrate the knowledge, skill and accident prevention awareness required to perform job planning, tool selection, machine set-up and operations associated with milling machines, including:

4.1 perform routine maintenance and lubrication operations on various lathes.

4.2 cite comparative characteristics of cutting tool/piece-part geometry, adapters, cutters, and work holding devices in a manner conductive to assuring an efficient set-up with safe machining conditions.

4.3 identify and set appropriate speed and feed parameters for machining.

4.4 set-up various work holding devices and mount the workpiece.

4.5 set-up and operate various types of milling machines, performing various operations commonly associated with mill work.

Competency 5: Demonstrate the knowledge, skill and accident prevention awareness required to perform job planning, tool selection, machine setup and operations associated with grinders and power saws, including:

5.1 perform routine maintenance and lubrication operations on various power saws and grinding machines.

5.2 select and mount specific wheels in regard to workpiece material, operations to be performed, and part geometry.

5.3 identify the various styles and types of wheels.

5.4 perform offhand grinding operations on pedestal and tool grinders.

5.5 identify the most appropriate workholding device for particular jobs and perform set-up of various devices.

5.6 select, prepare and install power saw blades and set up saws for various operations.

5.7 Utilize power saws to perform various machining operations on workpieces.

Competency 6: Demonstrate the knowledge, skills and accident prevention awareness required to perform job planning, tool selection, machine set-up and operations associated with hand tools, work holding devices (jigs and fixtures), and drilling machines, including:

6.1 perform preventative maintenance procedures on drilling machines.

6.2 describe procedures for setting-up jigs and fixtures on various machines.

6.3 select and use various hand tools to perform set-up, maintenance, and benchwork operations.

6.4 setup and operate various types of drilling machines, performing varied machining operations.

Required Course Textbook:

Machine Tool Technology

Repp, Victor E., & McCarthy, Willard J.
McKnight, Illinois

Required Course Workbook(s):

Machine Tool Technology Study Guides 1 and 2
McKnight, Illinois

Other: Vendor guides to carbide tooling selection

Course Competencies For

1. Title: Computer Assisted Drafting I — 3 credits
Two hours Lecture
Two hours Lab

2. Course Description: This course is designed to provide an overview of computer assisted drafting (CAD) and design (CADD). Topics covered in the course will include the benefits of adopting and implementing CAD/D. System hardware and software specifications and options will be covered. Generic and system specific instruction will be provided and students will learn how to operate system components leading to the setting-up, creating, revising and plotting of drawings on a CAD system.

Prerequisite: Technical Drafting and Print Interpretation GET___

3. Course Competencies/Behavioral Objectives

Competency 1: Define terms and acronyms commonly associated with computer-aided drafting, including:

1.1 Differentiate computer-aided drafting from computer-aided design.

1.2 Describe the function of and the difference between hardware, software, firmware and database.

1.3 Explain the difference between the terms input and output devices as well as processor, storage device, interactive graphics workstation, and turnkey package.

1.4 Discuss terms such as: bits, byte, word, chip, array processor, bus, port, interrupt, band, networking, stand alone system, database, memory devices, mainframe, minicomputer, microcomputer, host computer, server, user station.

1.5 Identify items such as: cathode ray tube, monitor/display keyboard, disc drive, peripheral diskettes, disk packs, modem, stylus, joystick, thumbwheel, puck, mouse, digitizer, light pen, pen plotter, printer.

1.6 Define terms such as: standard configuration, batch files, asynchronous communications adapter, menu, shell, filename, hard copy, soft copy, hard disk, floppy disk, storage, buffer, scrolling, parametric programs/macros, raster, refresh, resolution, pixal, post processpr, math coprocessor, jaggies, cursor, prompt, command, archive, library, alphanumeric, coordinate, password, repaint, rubberband, grid, array, matrix and function key.

1.7 Define and discuss acronyms such as: ROM, RAM, CRT, CPU, CAM, CIM, CAD, CADD, CAE, ALU, COM, 2-D, 2 1/2-D, 3-D, ANSI, ASCII, IGES, ENIAC, MODEM, IC, DOS, MACRO, PC, LAN.

1.8 define and discuss DOS commands such as: directory format, diskcopy, copy, erase and system commands such as: edit, font, mirror, move, plot, scale, save, window, frame, zoom, copy, rotate, translate, nest, hatch, fillet, file, read.

Competency 2: Discuss the benefits associated with computer aided drafting and identify current major application areas of CAD/D, as well as future applications, including:

2.1 Elaborate on the distinct advantages of CAD in regard to: speed, accuracy, revisions, neatness, legibility, cost, repetition, and shared data base.

2.2 Describe the prominent industrial applications of CAD/D to include: civil engineering and mapping, electrical/electronic, architectural and structural, piping and plant design, mechanical drafting and design, technical illustration, and finite element analysis, modeling, business graphics, graphs and charts.

2.3 Discuss present and future implications for CAD/D in regard to factory of the future concepts.

Competency 3: Elaborate on the function, specifications, and options available for a CAD system, including:

3.1 Provide an explanation of the function and specifications associated with system input devices such as keyboard, digitizer, stylus, light pen, puck, joystick, mouse, thumbwheel and demonstrate their use.

3.2 Provide an explanation of the function and specifications associated with system output devices such as monitor/display, disk drives, printer, and plotter.

3.3 Provide an explanation of the function and specifications associated with a system such as: processor, memory, interface ports, communication devices, operating system, languages, graphic libraries.

3.4 List the options available and cite the system characteristics achieved by selecting a specific package in regard to processing capability, memory capacity, storage devices, interface/communications capability, display graphics resolution, peripheral options, operating system, languages, libraries, system configuration.

3.5 Compare and contrast a stand-alone and a local area network system.

Competency 4: Explain, in general terms, the system capabilities commonly available for CAD, for CADD, and for CIM operations, including:

4.1 Describe commonly available technology for CAD systems.

4.2 Describe commonly available technology for CADD systems to include mass property calculations (surface area, volume, centroids, moments of inertia), 3D, wire frame modeling, routing of printed circuit board interconnects, rotation of an object.

4.3 Describe advanced technology CADD system capabilities to include bill of materials, family of parts (coding and classification) spline generation, surface shading imagery, cut away view, component placement (electronic design) solid modeling, 3D, simulation, finite element analysis.

4.4 Identify basic features of available technology for completing CIM functions commonly associated with CAD/CADD to include instrument/process control, scientific data analysis, engineering data analysis/CAE.

Competency 5: Utilize an interactive graphics workstation to create and modify CAD drawings and produce hard copies of the same, including:

5.1 Apply the use of input devices to create CAD drawings.

5.2 Demonstrate the use of software features to perform grid coordinate selection, geometry element development, line style selection, dimension selection, select fonts, generate text, crosshatch, mirror image, copy, erase, window, zoom.

5.3 Create basic geometry and construct orthographic drawings using CAD.

5.4 Create dimension drawings, add text to drawings, create various section drawings, edit drawings, create and merge symbols into drawings.

5.5 Perform utility functions to manipulate drawing files, print/plot hard copy, and archive drawings.

Required Course Textbooks:

Fundamentals of CAD, Bertoline, Gary R. Delmar, Albany, NY 1985
ISBN 0-8273-2332-8
ISBN 0-8273-2333-6 (Instructor's Guide)

CAD/CAM: Computer-Aided Design & Manufacturing, Groover, Mikell P, and Zimmers, Jr., Emory W., Prentice Hall, NJ. 1984
ISBN 0-13-110130-7

Note: This text will be a required text for a second year course also -- CAD instruction will involve 6 of 22 chapters.

Other -- system specific software/operator's manual

Methods of Instruction:

Lecture and discussion, assignments, demonstrations and laboratory sessions.

Methods of Evaluation:

Quizzes, written assignments, class discussion, laboratory project completion.

Equipment:

Standard classroom/media projection equipment, appropriate laboratory equipment.

Recommended Agencies for Instructional Material:

(System Software/Hardware Vendors)

Career Aids, Inc.
20417 Nordhoff St., Dept. 1N4
Chatsworth, CA 91311
(818) 341-8200

Creative Publishing Co.
Box 9292
College Station, TX 77840

Delmar Publishers, Inc.
2 Computer Drive, West
Box 15015
Albany, NY 12212

Other Instructional Material Sources:

National Computer Graphics Association
P.O. Box 3412
McLean, Virginia 22103

Various manufacturers and vendors of CAD hardware and software

Course Competencies For:

1. Title: Industrial Safety GET___ 1 credit
One Hour Lecture

2. Course Description: This course is designed to provide instruction in industrial safety and accident prevention for employees and managers. Occupational Safety and Health Act (OSHA) of 1970 requirements are stressed. Administrative aspects of record keeping, rights and responsibilities, standards, safety program development and implementation are also covered. The student will receive basic instruction on the identification of accident causes and become aware of the steps required to prevent industrial accidents.

3. Course Competencies/Behavioral Objectives

Upon successful completion of this course, the student should be able to:

Competency 1: Demonstrate an awareness of definitions and a basic understanding of safety and accident prevention practices and procedures, including:

1.1 provide basic definitions associated with accident prevention.

1.2 describe how accident and injury rates are determined.

1.3 explain how accidents occur and how they can be avoided/prevented.

1.4 list environmental and human factors contributing to accidents.

1.5 identify job/work factors involved in accidents.

Competency 2: Demonstrate an understanding of voluntary compliance program legislation including:

2.1 policies affecting the legal and moral considerations associated with accidents to include--responsibility, liability and accountability.

2.2 explain the reasons why management and employees should assume responsibility for accident prevention.

2.3 identify the various levels at which laws-ordinances-regulations-codes-standards have been adopted to protect individuals.

2.4 describe relevant national legislation and regulations affecting occupational safety and health.

Competency 3: Demonstrate an understanding for the provisions and implications of a voluntary compliance accident prevention program, including:

3.1 describe the elements of a viable program.

3.2 explain how to establish an administrative scheme for assignment of levels of responsibility.

3.3 develop a scheme for planning a program.

3.4 develop a scheme for implementing a program.

3.5 develop a plan for reviewing, auditing and enhancing an accident prevention program.

3.6 list sources of assistance for guidance, problem-solving, administration, and implementation of a local program.

Competency 4: Identify the important aspects of administering a voluntary compliance accident prevention program under the Occupational Safety and Health Act.

4.1 describe how and where to obtain current information regarding standards adopted under the Act.

4.2 identify guidelines and procedures for developing and maintaining record-keeping forms.

4.3 cite the specific rights and responsibilities of employers and employees under the Act.

4.4 develop various policy statements and forms for implementing a program in accordance with the OSHAct.

Required course textbook:

Supervisors Safety Manual
National Safety Council, 444 N. Michigan Avenue, Chicago, IL 60611 (312) 527-4800

Recommended course reference text materials:

1) General Industry OSHA Safety and Health Standards (29CFR1910) OSHA 2206
Department of Labor, Occupational Safety and Health Administration (available at no cost from local OSHA office)

2) The OSHA Act of 1970 - OSHA 2001 -No cost - Local OSHA office.

3) Safety & Health Regulations for Construction, 29CFR 1926
Department of Labor, Occupational Safety and Health Administration
(available at no cost from local OSHA office)

Recommended instructor references:

Note: It is recommended that the following be acquired, kept on file, and issued to course instructor:

**OSHA Safety & Health Training Guidelines for General Industry (PB-239 310/AS)

**OSHA Safety & Health Training Guidelines for Construction (PB-239312A/S)

**Available from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22151

One FREE copy of the following can be obtained from the local OSHA area or regional office:

OSHA Handbook for Small Businesses OSHA 2209
Construction Industry, OSHA 2202
General Industry, OSHA 2206
Organizing a Safety Committee, OSHA 2231
OSHA Inspections, OSHA 2098
Essentials of Machine Guarding, OSHA 2227
Excavation and Trenching Operations, OSHA 2226
OSHA Your Workplace Rights in Action, OSHA 3032
Noise, OSHA 2067
Recordkeeping Requirements Under the OSHA of 1970
What Every Employer Needs to Know About OSHA Recordkeeping, OSHA 412-
Job Safety and Health Protection, OSHA 2203 (Poster)
All About OSHA, OSHA 2056
Publications on Toxic Substances, A Descriptive Listing: Published by Interagency Regulatory Liaison Group (Available through OSHA or EPA)

Recommended Agencies for Other Instructional Materials:

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
6500 Glenway Ave., Bldg. D-5, Cincinnati, OH 45211

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)
475 Wolf Ledges Parkway, Akron, OH 44311

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1430 Broadway, New York, NY

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE)
850 Busse Road, Park Ridge, IL

AMERICAN WELDING SOCIETY (AWS)
2501 N.W. 2nd Street, Miami, FL 33125

BEST, A.M. & CO. (Best's Loss Control)
Amherst Road, Olkwick, NJ 08850

BUREAU OF NATIONAL AFFAIRS (BNA)
1231 25th Street, N.W., Washington, DC 20037

CHEMTREC HOT LINE for emergency spills of combustible and flammable liquids and caustic acids

CODE OF FEDERAL REGULATIONS (CFR)
Superintendent of Documents, U.S. Government Printing Office
Washington, DC 20402

COMMERCE CLEARING HOUSE (CCH)
4025 W. Peterson Ave., Chicago, IL 60646

COMPRESSED GAS ASSOCIATION, INC.
1235 Jefferson Davis Highway, Arlington, VA 22202

DEPARTMENT OF TRANSPORTATION (DOT), Materials Transportation Bureau Information Services Division, Washington, DC 20590

FACTORY MUTUAL ENGINEERING (Factory Mutual System)
1151 Boston-Providence Turnpike, Norwood, MA 02062

FEDERAL REGISTER
Superintendent of Documents, U.S. Government Printing Office
Washington, DC 20402

NATIONAL AUDIOVISUAL CENTER (GSA), Information Services,
8700 Edgeworth Drive, Capital Heights, MD 20743

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
Batterymark Park, Quincy, MA 02269

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH - (NIOSH)
4676 Columbia Parkway, Cincinnati, OH 45226

NATIONAL SAFETY COUNCIL (NSC)
425 N. Michigan Ave., Chicago, IL 60611

NATIONAL TECHNICAL INFORMATION SERVICE (NTIS)
5285 Port Royal Road, Springfield, VA 22161

SUPERINTENDENT OF DOCUMENTS U.S. GOVERNMENT PRINTING OFFICE
Washington, DC 20402

TECHNICAL DATA CENTER (TDC)
U.S. Dept. of Labor OSHA, TDC Room 2439, rear
200 Constitution Ave., NW, Washington, DC 20210

FOR RENTAL AND/OR PURCHASING OF VISUAL AIDS, CATALOGS SENT ON REQUEST.

THE GREATER CHICAGO SAFETY COUNCIL, INC. (Rental Only)
One North La Salle St., Chicago, IL 60602

NATIONAL ARCHIVES & RECORD SERVICE National Audiovisual Center, GSA Reference Section, Washington, DC 20409

ARTICULATION

(Secondary and Post-Secondary Education)

Vocational/occupational education supports the needs of local business and industry and prepares workers with entry-level skills. The need for articulation of programs is becoming more apparent due to growing local and national concerns for efficiency in education, rising costs of education, and elimination of duplication of effort and demands from the public for accountability.

Coordination of secondary and post-secondary programs was a major theme of the 1976 Federal educational legislation. The 1983 efforts of the Pennsylvania Advisory Council on Vocational Education fostered, among other things, stronger business and industry linkages with vocational programs and articulation efforts between secondary and post-secondary and adult vocational education programs.

In 1983, the Pennsylvania Advisory Council on Vocational Education made a recommendation on articulation agreements. The recommendation, as it addressed articulation, stated:

> 4. Articulation agreements between comprehensive schools, community colleges, colleges, universities and AVTS should be established. These agreements should stimulate joint efforts in facilities' utilization, curriculum planning, providing customized job training, utilizing business/industry contracts, etc. These agreements would be considered in the approval process for receiving state and federal vocational education funds.

Further, articulating programs between secondary area vocational-technical schools and the local community college would maximize the efforts and efficiency of our state educational system. This integration would be efficient and economical in terms of better use of facilities, staff and equipment, reduced length of study time, and the ability to address employer needs in a systematic plan.

In the development of this curriculum, the Computer Integrated Manufacturing/Computer-Aided Manufacturing program, it was intended to build upon maximum integration of at least two major state education delivery systems, the community college and the secondary vocational-technical system. With this articulation plan and cooperation in mind, a decision must be made as to which students could profit the most from this learning experience.

Generally speaking, secondary students with a mechanical and/or drafting background seemed to have many of the basic skills necessary for a smooth articulation. This general category of mechanical trades and drafting suggested students from course selections such as:

* Drafting and Design
* Machine Shop
* Welding
* Appliance Repair
* Computer Service

* Electronics
* Welding, and other courses as deemed appropriate by a joint committee of the community college and the area vocational-technical school.

Specific courses which seem to be appropriate or reasonable starting points of exploration of articulation include:

* Technical Drafting,
* Technical Mathematics,
* Technical Physics,
* First Aid/Safety,
* Computer-Assisted Drafting, and
* Industrial Processes Laboratory

While no one student would be expected to possess the background and/or competencies in all of the above courses, different students from various courses (programs) would have completed parts of or complete courses. Again, the determination of breadth, depth and evaluation of the articulation process should be determined by the joint committee.

Other courses not mentioned above should also be waived by students possessing competency in that area. Usually most institutions have an evaluation mechanism to assess that background.

PROPOSED SECOND YEAR COURSE LISTING

LUZERNE COUNTY COMMUNITY COLLEGE

CIM
Second Year

Third Semester

	Credits
CAD II	3 (1 hr lect/
GET ____*	4 hr lab)
CAMachining I	3 (2 hr lect/
GET ____*	2 hr lab)
CNC Mach Tool Setup/Operation	2 (1 hr lect/
GET ____*	2 hr.lab
Fundamentals of Speech	3
SPE 125	
Technical Physics I	4
PHY 123	
Tech Report Writing	3
ENG 261	
	18

Fourth Semester

	Credits
Health/Physical Education	1
General Psych	3
PSy 103	
CAMachning II	3 (2 hr lect/
GET ____*	2 hr lab)
Technical Physics II	4
PHY 124	
CIM	3 (2 hr lect/
GET ____*	2 hr lab)
	14

SECTION IV

COMPUTER INTEGRATED MANUFACTURING TECHNOLOGY

EDUCATIONAL SPECIFICATIONS

COMPUTER INTEGRATED MANUFACTURING TECHNOLOGY

A. PROGRAM DESCRIPTION

Both A.A.S. Degree and Certificate programs are being developed for this program. The CIM Technology program trains technicians for employment in modern computerized manufacturing industries. Such technicians produce production parts by using computer-controlled machine tools and similar sophisticated equipment.

Technicians trained in CIM also operate and maintain CAD/ CAM (Computer Aided Design/Computer Aided Manufacturing) systems that are often organized into "work cells." The operation of a work cell includes: the entry of given data into a CAD/CAM system and the subsequent production of CNC (Computerized Numerical Control) generated parts. The operation of a work cell often includes the integration of robotics, material handling and quality assurance with CAD/CAM.

Computer Integrated Manufacturing Technology students study CNC machine operation and programming, CAD (Computer Aided Design), integrated CAD/CAM, robotics, basic statistical process control, fluid power, and basic industrial engineering concepts common to manufacturing. Employment in the field of automated manufacturing is expected to increase faster than the average for all occupations through the 1990's.

B. EDUCATIONAL OBJECTIVES

Upon completion of the program the student will be able to:

1. Produce machined parts on computer-controlled machine tools.
2. Produce hard copy part-prints on a 2-D computer-aided design (CAD) system.
3. Operate and maintain an integrated manufacturing system to include a robot, a conveyor and a machine tool.
4. Apply mathematics skills in the area of metrics, geometry, trigonometry, and algebra as they relate to machine tooling.
5. Perform machine tool processes to include grinding, forming, turning, boring, milling and drilling.
6. Apply basic CAM processes to include the interpretation of part-prints and process sheets, and the development of simple tools and fixtures for automated machine tools.
7. Select machine tools and define their applications and limitations.
8. Apply statistical process control in producing quality parts.
9. Apply principles of metallurgy to include machinability of metals, hardness, and heat treating.
10. Apply manufacturing planning skills.
11. Program a CNC machine tool using a common programming language to produce a given part.

12. Program a machine tool via conversational language to produce a given part.
13. Demonstrate basic computer application skills and basic programming skills.
14. Demonstrate the ability to work and learn with other people in a productive manner.
15. Develop a knowledge of materials common to the manufacturing industry such as metals, plastics, woods and ceramics.
16. Provide routine maintenance and repair of automated manufacturing systems..
17. Demonstrate an understanding of industrial robots and their applications.
18. Earn an associate degree by fulfilling the requirements in English, political science, physical education, and natural science.

C. COURSE LISTING

Courses similar to the following will be developed for this new program at Luzerne County Community College:

Industrial Processes
Introductory Machine Operations
Intermediate Machine Operations
Metallurgy
CNC and NC Machine Programming
CAM Machine Programming
CAM Operations and Processing
Integration of CAD/CAM Processes
Programming Industrial Robots
Materials Handling
Introduction to Robotics
Hydraulics
Pneumatics
Quality Assurance
Basic Statistical Process Control
Gages of Measurement
Geometric Tolerancing

D. MAJOR LEARNING ACTIVITIES

Students will analyze, design and perform automated manufacturing processes including materials handling in a variety of laboratories. Laboratory activities will be supported by related classroom instruction.

E. INSTRUCTIONAL SPACE REQUIREMENTS

The following laboratories are required for this program:

AREA	SQ. FT.
Computer Integrated Manufacturing Lab (CIM)	4,187
Robotics Lab	2,048
Fluid Power	1,615
Manufacturing Processes Lab (Machine Shop)	2,146
CAD/CAM Lab	1,805

F. SUPPORT SPACE REQUIREMENTS

AREA	SQ. FT.
Tool Room	135
CIM Storage Room	209
Manufacturing Processes Storage Room	93
Robotics Storage Room	345
Fluid Power Storage Room	358
Faculty Offices (6) (includes Laser/Electro-Optics Technology)	480

G. LOCATION RELATIONSHIPS

All of the laboratories require grade level access. The robotics lab and the automated machines lab need to be immediately adjacent to the CIM lab. The fluidics lab needs to be in close proximity to the above labs as does the CAD/CAM lab.

H. GENERAL DEVELOPMENT OF PHYSICAL PLANT

1. Climate Control

a. A temperature of 65 degrees should be maintained during the winter months.
b. This area should be air conditioned.
c. The space should have a separate thermostat.

2. Acoustical Factors

This laboratory is a low to medium noise level area and requires a STC rating of 42.

3. Illumination Factors

This laboratory requires 50 to 70 footcandles at the working surface.

4. Aesthetic Factors

Should be similar to high quality spaces in industry.

5. Storage Facilities

a. Storage requirement size is stated under Support Space. This space will be utilized to store test equipment, tools and components.
b. Provide wall mounted coat hangers sized to accommodate 24 students.

6. Vertical Instructional Surfaces

No special requirements.

7. Utility Considerations

a. Electrical

1) Provide 110v. duplex outlets at 4'0" o.c. around the perimeter of the lab.
2) Provide 480v., 3 phase.
3) Provide 240v., 1 phase.
4) Provide 240v., 3 phase.
5) Provide 100 psi air wall outlets, 30 psi duster heads, one outlet required.
6) Provide CCTV cabling and jack plate in the lab.

7) Provide master emergency switches in all circuits with lock out.
8) Provide a ground fault circuit interrupter.
9) Provide compouter cabling and jack plate in lab.
10) Provide a telephone line in the laboratory.
11) Provide a wall mounted analog clock (electric) in the lab.
12) Provide under floor ducting for electrical cabling.

b. Mechanical

1) Provide hot and cold water.
2) Provide a floor drain.

NOTE: All utilities should be overhead. All 110v. power must be clean.

8. Sanitation Requirements

Provide in counter sink for clean-up.

9. Display Areas

No special requirements.

10. Provisions for Handicapped Students

General architectural provisions as required and special equipment where possible.

11. Special Entrances or Exits

See "Door Considerations".

12. Special Built-in Equipment

See equipment lists.

13. Outside Lab Considerations

No special requirements.

14. Material Receiving and Shipping Requirements

No special requirements.

15. Type and Size of Outdoor Areas

No special requirements.

16. Surface Types

a. Masonry walls should be painted with oil base semi-gloss enamel.
b. Plaster and gypboard walls should be painted with semi-gloss enamel and have a 7'0" high epoxy wainscot.
c. Floors should be sealed concrete.
d. Ceilings should be acoustically treated.
e. Provide a vision panel the entire length of industrial production cell 32" above finished floor to robotics lab.

17. Door Considerations

a. All single doors to be 40" minimum.
b. A 10' x 10' overhead door is required to robotics lab.

18. Ceiling Height

The ceiling height should be 14' minimum.

19. Window Considerations

Vision panels from corridor.

I. MAINTENANCE AND SAFETY FACTORS

1. Unusual Maintenance Problems

No special requirements.

2. Safety Factors

a. Panic or emergency electrical shut-off.
b. Emergency eyewash.
c. Special safety considerations for robots (pressure pads, electric eye, barriers, etc.)

M. GENERAL DEVELOPMENT OF PHYSICAL PLANT

1. Climate Control

a. A temperature of 65 degrees should be maintained during the winter months.
b. Laboratories should be air conditioned. NOTE: Cad labs may require extra A/C capacity.
c. Each lab should be controlled separately with a thermostat.

2. Acoustical Factors

This area is relatively quiet and requires a STC rating of 37.

3. Illumination Factors

a. A non-glare lighting level of 50 to 70 footcandles is required at the working surface. Specific lighting should be provided where required.
b. The lighting in the laboratory should be controlled with a solid state rheostat.

4. Aesthetic Factors

The laboratory should closely approximate a professional drafting room with respect to environment and arrangement of furniture.

5. Storage Facilities

a. Provide base cabinets for storage with counter top and adjustable open shelving for reference materials.
b. Provide wall mounted coat rack capable of accommodating 24 students in each laboratory.

6. Vertical Instructional Surfaces

a. Provide a 4' x 16' "write-on/wipe-off" board in each lab.
b. Provide (2) 4' x 4' tackboards in each lab.
c. Provide a wall mounted pull-down screen in each lab.

7. Utility Considerations

a. Electrical

1) Provide 120v. four plex outlets at 10'0" o.c. on perimeter walls. NOTE: Clean power must be provided to all cad stations.

2) Provide 120v. duplex outlets, one per wall in print room.
3) Provide a wall mounted analog clock (electric) in each lab.
4) Provide CCTV cabling and jack plate in each lab.
5) Provide computer cabling and jack plate in each lab.
6) Provide (6) power poles in each lab.

b. Mechanical

1) Provide hot and cold water in each lab.
2) Provide sink drain in each lab.
3) Provide exhaust hood in print room.

8. Sanitation Requirements

Provide a sink in the counter top in each lab.

9. Display Areas

Sufficient tackstrip for display of drawings in each lab.

10. Provisions for Handicapped Students

General architectural provisions as required.

11. Special Entrances or Exits

No special requirements.

12. Special Built-in Equipment

See equipment lists.

13. Outside Lab Considerations

No special requirements.

14. Material Receiving and Shipping Requirements

No special requirements.

15. Type and Size of Outdoor Areas

No special requirements.

16. Surface Types

a. Provide raised carbon backed carpeted computer floors in the labs and resilient tile in print/storage areas.
b. Ceiling should be acoustical lay-in type in all areas.
c. Walls in each area shall be painted or have vinyl wall covering.

17. Door Considerations

All man doors should be 40" wide.

18. Ceiling Height

Ceiling height should be a minimum of 9 feet clear in all areas.

19. Window Considerations

No special requirements.

I. MAINTENANCE AND SAFETY FACTORS

1. Unusual Maintenance Problems

No special requirements.

2. Safety Factors

Provide Haylon Fire Suppression System in Cad labs.

MANUFACTURING PROCESSES LAB (MACHINE SHOP)

H. GENERAL DEVELOPMENT OF PHYSICAL PLANT

1. Climate Control

   a. A temperature of 65 degrees should be maintained during the winter months.
   b. The laboratories should be air conditioned.
   c. Each space should have a separate thermostat.

2. Acoustical Factors

   The lab is a high noise area and requires a STC rating of 52. Acoustical metal deck or tectum should be provided as a decking material.

3. Illumination Factors

   a. General task illumination should be 50 to 70 footcandles.
   b. Each machine to have its own work lamp for specific lighting where possible.

4. Aesthetic Factors

   The walls in this area should be painted a light color. Supergraphics are a possibility for the identification of the area.

5. Storage Facilities

   a. The storage room will be used to store ferrous and non-ferrous metals, machine accessories, precision hand tools, parts and hardware.
   b. Additional tool storage will be in the lab on wall and machine mounted panels.
   c. Special storage is required for various oils.
   d. Provide wall mounted coat racks (24 per lab).

6. Vertical Instructional Surfaces

   a. Provide (1) 4' x 16' whiteboard in each lab.
   b. Provide (2) 4' x 4' wall mounted tackboards adjacent to the student clean-up area in each lab.

7. Utility Considerations

   a. Electrical

      1) Provide 480v., 3 phase.
      2) Provide 240v., 1 phase.
      3) Provide 240v., 3 phase.

4) Provide 110vac. overhead reels and wall outlets, (6) equally distributed.
5) Provide 100 psi air wall outlets, (6) equally distributed.
6) Provide electrical master shut-off switches, panic type.
7) Provide electrical master shut-off at central location with lock-out.
8) Provide 110v. duplex outlets at 10'-0" o.c. around the perimeter of lab.
9) Provide computer cabling and jack plate in office.
10) Provide CCTV cabling and jack plate in each lab.
11) Provide a telephone for each staff office.

b. Mechanical

1) Provide a drain in heat treat area.
2) Provide natural gas to heat treat furnace and kiln.
3) Provide hot and cold water in clean-up area.
4) Provide waste drains for corrosive solvents.
5) Provide exhaust hood in heat treat area.

8. Sanitation Requirements

Provide a clean-up area with a half round Bradley.

9. Display Areas

No special requirements.

10. Provisions for Handicapped Students

General architectural provisions as required and special equipment as needed.

11. Special Entrances or Exits

No special requirements.

12. Special Built-in Equipment

See equipment list.

13. Outside Lab Considerations

No special requirements.

14. Material Receiving and Shipping Requirements

Steel stock material will be received and stored in this shop so a delivery/service drive will be required at loading dock.

15. Type and Size of Outdoor Areas

No special requirements.

16. Surface Types

a. Provide hardened and sealed concrete floor in lab.
b. Masonry walls should be painted with oil base semi-gloss enamel.
c. Plaster and gypboard walls should be painted with semi-gloss enamel and have a 7'-0" high epoxy wainscot.
d. Ceiling should be acoustically treated.

17. Door Considerations

a. A 10' x 10' overhead door will be required for machine and stock movement.
b. All man doors should be 40".
c. Provide (1) dutch door to storage room for potential use as tool crib.

18. Ceiling Height

The clear ceiling height for this area should be a minimum of 12'-0".

19. Window Considerations

Vision panels from corridor.

I. MAINTENANCE AND SAFETY FACTORS

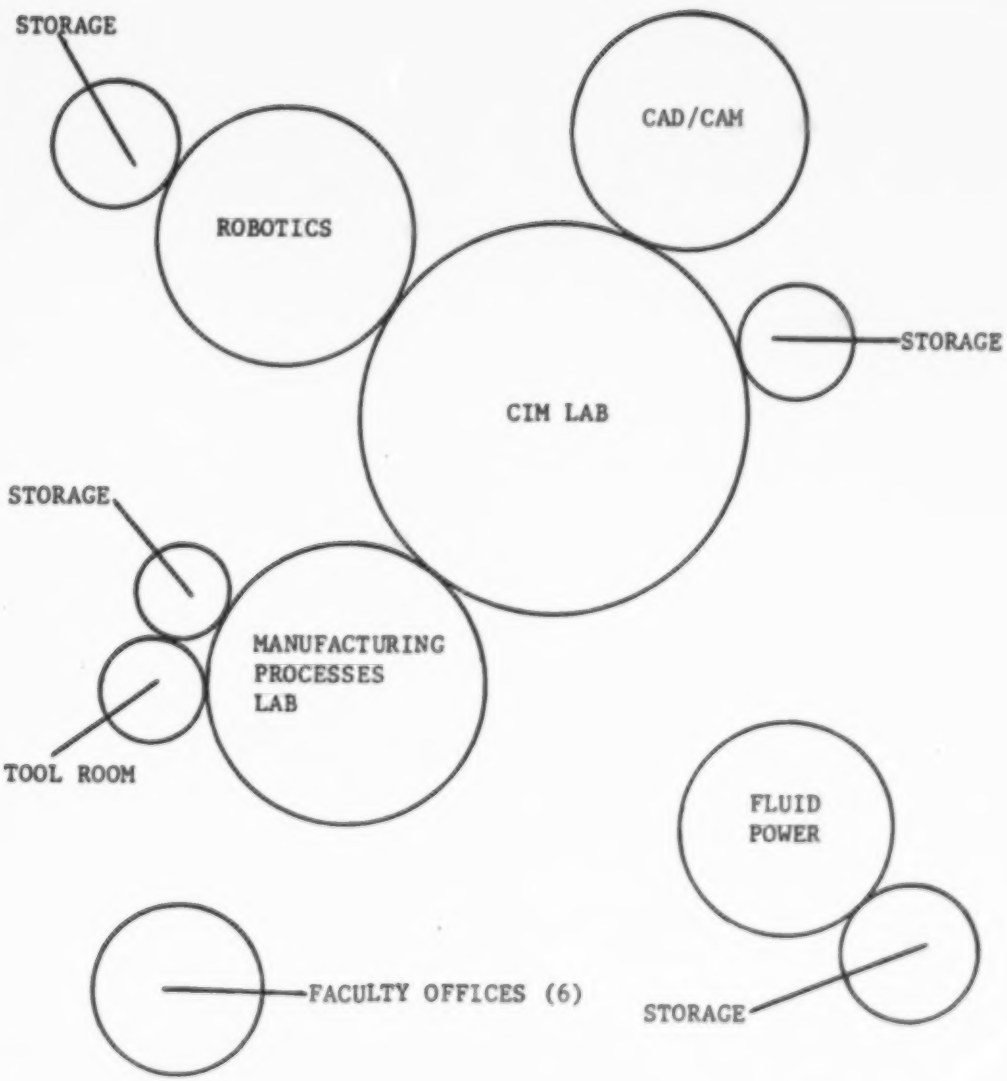
1. Unusual Maintenance Problems

Clean-up of oils, solvents and metal chips.

2. Safety Factors

a. All machines must be properly guarded and controlled according to OSHA standards.
b. Floor to identify by tape safety lines around machinery.

J. FACILITY SPACE CONCEPTUAL



SECTION V

COMPUTER INTEGRATED MANUFACTURING TECHNOLOGY

EQUIPMENT SPECIFICATIONS

ALGER, DOWLING, PAULLIN, INC.
P.O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Computer Integrated Manufacturing
DRAWING NO.:

ROOM NO.:
ORIGINATION DATE: 2-13-87

REVISIONS
4-17-87

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL					MECHANICAL					COMMENTS
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.	
	32LF	Markerboard, 16LF two locations	$3,200.00	F												
	16LF	Tackboard, 4LF four locations	$800.00	F												
	1	Projection Screen, wall mtd.	$150.00	F												
	AR	Electrical Power Distribution, in floor and wall mounted in raceway	NA	F												By Elec. Contractor
	AR	Data Cable Data Distribution in floor and wall mounted in raceway	NA	F												By Elec. Contractor
	AR	CCTV Cable Distribution in floor and wall mounted in raceway	NA	F												By Elec. Contractor
	1	Master Keyed Electrical Power Control	NA	F												By Elec. Contractor
	4	Panic Type Electrical Shut-Off Controls	NA	F												By Elec. Contractor
	AR	Compressed Air Distribution in floor and wall mounted disconnects	NA	F							X					By Mech. Contractor; 100 PSI; Instrument Air
	AR	Air Regulators, wall mounted	NA	F												By Mech. Contractor
	AR	Data Cable Connection to remote computer mainframe from this lab	NA	F												By Elec. Contractor
	3	Computer Terminals or Microcomputers for interface with work cells, portable	$6,000.00	M			120	1	5	C						Data link to LAN
	1	Computer Terminal, #VT241	NA	E			120	1	5	C						Data link to LAN

ALGER, DOWLING, PAULLIN, INC.
P. O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Computer Integrated Manufacturing, cont.
DRAWING NO.:

ROOM NO.:
ORIGINATION DATE: 2-13-87

REVISIONS
4-17-87

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL					MECHANICAL					COMMENTS
						H.P.	VOLTAGE	PHASE	AMPS	CONN C/D	AIR	EXHAUST	GAS	WATER	FL. DR.	
	2	Work Stations for computer terminals or microcomputers	$1,440.00	M												
	2	Chairs, posture type	$500.00	M												
	6	Programmable Controllers, for work cells	$73,500.00	M			HA									Data link to LAN
	1-set	Mechanical Hand Tools with storage unit	$2,200.00	M	60"x24"x84"											
	1-set	Electrical/Electronic Hand Tools with storage unit	$1,900.00	M	60"x24"x84"											
	3	Sets of Safety Fencing for work cells	$2,500.00	M	See Plan											
	3	Floor Pads, safety type, for work cells	$1,500.00	M	See Plan											
	4	Video Cameras, port., for use throughout laboratory	$2,000.00	M	See Plan											
	2	Video Control Console for remote camera locations, recording and monitoring	$2,400.00	M	Portable		120	1	*	C						*250 watts; CCTV link
	2	Television Monitor for control and monitoring	$350.00	M	Portable		120	1	*	C						*100 watts; CCTV link
	2	File Cabinets, four drawer	$625.00	M	18"x28"x52"											
	1	Bookshelving Units, documentation type	$260.00	M	72"x12"x42"											
	4	Workbench Units, lab support type, with vises	$1,212.00	M	84"x36"x36"											

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ALGER, DOWLING, PAULLIN, INC.
P.O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Computer Integrated Manufacturing, cont.
DRAWING NO.:

ROOM NO.:
ORIGINATION DATE: 2-13-87

REVISIONS
4-17-87

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL					MECHANICAL					COMMENTS:
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.	
	1	Dolly, low type, machinery moving	$400.00	M												
	8	Storage Cabinets, double door, locking	$2,000.00	M	36"x24"x84"											
	1	Machining Center, having CNC control, machine load and unload robot, monitor and sensors	$148,000.00	M	145"x10"x96" 9' dia.	5	208 208	3 3	 *	D D	X X					*9.5KVA; 100 PSI; 8,000 lbs.; 1,550 lbs.
	1	Automated Storage and Retrieval System, vertical type, with robot for loading and unloading	$31,200.00	M	12'x48"x84"		120	1	20		X					*100 PSI; 10 CFM
	3	Work Cell and control and consoles having computer interface with work cell and programmable controllers	$4,800.00	M												Portable
	1	Automatic Guided Vehicles, computer controlled for material handling operations entering work cell	$6,500.00	M												Portable X
	1	Turning Center, having machine load/unload robot, sensors and monitor	$97,000.00	M	147"x70"x82" 9' dia.	20	208 208 208	3 3 3	 * *	D D D	X X					100 PSI; 13,800 lbs. *3KVA 100 PSI; *9.5KVA; 1,550 lbs.
	1	Robot, electro-hydraulic, servo type, 6-axis, with work cell, controller	$58,000.00	M	72"x60"x60"	5	208	3		D	X					100 PSI; 600 lbs.
	1	Robot, DC electric servo, 4-axis, Seara arm type, with work cell	$48,000.00	M	72"x60"x60"	5	208	3		D	X					*100 PSI; 450 lbs.

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ALGER, DOWLING, PAULLIN, INC.
P.O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Computer Integrated Manufacturing, cont.
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ROOM NO.:
ORIGINATION DATE: 2-13-87

REVISIONS
4-17-87

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL						MECHANICAL					COMMENTS:
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.		
	1	Robot, pneumatic, 4-axis, with work cell and controller, and air logic	$21,000.00	M	72"x60"x60"		120	1	10	C	X						100 PSI; 20 CFM
	1	Computer Integrated Manufacturing Development Center, consisting of:	See Below	M													
		(1) Conveyor, floor standing, loop type, with electric drive	$30,205.00	M	See Plan	(4) 1/3	120	1		C	100						
		(1) Robot, scara arm type, DC, electric servo control, 4-axis,	$42,500.00	M	30"x12"x16"		120 120	1 1	10 *	C C	100						* 2 kVA
		(1) Robot, polar-coordinate, electro-hydraulic servo control, 6-axis	$6,800.00	M	36"x32"x30"	1	120 208	1 3	10	C D	100						
		(1) Robot, cylindrical-coordinate, pneumatic, 4-axis	$12,535.00	M	36"x32"x30"		120	1	10	C	100						
		(1) Microcomputer, with CRT, dual disk drives and accessories to operate CIM cell	$9,500.00	M	48"x36"x30"		120	1	12	C							Data link to CAD lab
		(1) Local Area Network, for micro-computer control of CIM cell, Amnet #861	$21,500.00	M	N/A												Data link to CAD lab
		(1) Machining Center, CNC control, with tool changer	$58,000.00	M	72"x36"x66"	1	208	3		D							
		(1) Printer, statistical data type, for use with CIM cell, microcomputer and programmable controller	$2,500.00	M	36"x30"x34"		120	1	4	D							Data link to CAD lab

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ALGER, DOWLING, PAULLIN, INC.
P. O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Computer Integrated Manufacturing, cont.
DRAWING NO.:
ROOM NO.:
ORIGINATION DATE: 2-13-87
REVISIONS: 4-17-87

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL: H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	MECHANICAL: AIR	EXHAUST	GAS	WATER	FL. DR.	COMMENTS:
		(1) Programmable Controller, to program and operate CIM cell through local area network, portable	See Bobots	M												Data link to CIM system
		(1) Bar Code Reader System, integrated with controller, microcomputer and CAM	$3,000.00	M	NA											Data link to controller
		(1-set) #RS232C Data Communications Links	See Bobots	M	NA											Data link to controller
		(1) CAD/CAM Software for cell interface to CAD/CAM laboratory	See CIM Software	M	NA											
		(1) Computer Intragrated Manufacturing Microcomputer Software Package, to operate cell	$26,466.00	M	NA											Data link to work cell
		(1-set) Safety Guards and Wiring	$3,600.00	M	See Plan											
		(4) Pallet Positioners	$11,340.00	M	NA											
		(4) Carrier Pallets	$11,340.00	M	NA											
		(1) Fiber Optic Sensing Unit, to integrate with cell operation	See ASRS	M	NA											
		(1) Manufacturing Data Analysis Software Package, microcomputer, CAM and CIM cell compatible	See CIM Software	M	NA											

ALGER, DOWLING, PAULLIN, INC.
P.O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Computer Integrated Manufacturing, cont.

ROOM NO.:

REVISIONS

DRAWING NO.:

ORIGINATION DATE:

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL					MECHANICAL					COMMENTS:
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.	
	2	Robot, industrial type, 6 axis, electric servo with karel controls	$12,000.00	M	44"X28"X9' dia.	208	3	50	0							Data link to LAM
		FIXED TOTAL	$4,150.00													
		MOVABLE TOTAL	$764,573.00													
		GRAND TOTAL	$768,723.00													

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ALGER, DOWLING, PAULLIN, INC.
P. O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Manufacturing Process/CNC Lab
DRAWING NO.:
ROOM NO.:
ORIGINATION DATE: 2-13-87
REVISIONS: 4-17-87

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL: H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	MECHANICAL: AIR	EXHAUST	GAS	WATER	FL. DR.	COMMENTS:
	1	Coat Rack, student	$150.00	F												
	1	Projection Screen, wall mtd.	$150.00	F												
	4	Safety Shut-Off Switches, panic type	NA	F												By Elec. Contractor
	1	Master Keyed Electrical Control to Lab	NA	F												By Elec. Contractor
	1	Sink, wash	NA	F												By Mech. Contractor
	1	Monorail with one-ton hoist	NA	F												By Gen. Contractor
	1	Hood, exhaust type, for heat treat equipment	NA	F												By Mech. Contractor
		DRILLING:														
	1	Drill Press, 15" cap., floor standing, variable speed drive, Rockwell	NA	E	24"x28"x74"	1	208	3		D						
	1	Drill Press, 20" capacity, floor standing, variable speed drive	$3,800.00	M	24"x36"x75"	1-1/2	208	3		D						
		LATHES:														
	2	Lathe, metal, 10" cap., 30" to 60" center distance, variable speed drive, straight, Rockwell	NA	E	60"x28"x52"	2	208	3		D						

ALGER, DOWLING, PAULLIN, INC.
P.O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Manufacturing Process/CNC Lab, cont. ROOM NO.:

DRAWING NO.: ORIGINATION DATE: 2-13-87

REVISIONS 4-17-87

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL					MECHANICAL					COMMENTS:
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.	
	2	Lathe, metal, 13" cap., 48" to 84" center distance, geared head drive, straight bed, Colchester	$28,000.00	M	78"x37"x48"	4	208	3		D						
	2	Lathe, metal, computer numerical control, trainer type	$76,000.00	M/E	72"x36"x42"	1/4	120	1		D						Data link to CAM
		MILLING:														
	2	Milling Machine, vertical, floor standing, ram and turret type, 9" x 42" table, Wells	$15,000.00	M/E	92"x63"x83"	2	208	3		D						(1) existing, (1) new
	1	CNC Mill Trainer	$4,000.00	M	72"x36"x42"	1/4	120	1		D						Data link to CAM
		GRINDING:														
	1	Grinder, tool and cutter, floor standing, Harig	$7,200.00	M	62"x40"x61"	1	208	3		D						
	1	Grinder, surface, 7" x 18" cap., floor standing, manual hand feed, K.O. Lee	NA	E	68" x 43"	1-1/2	208	3		D						
	2	Grinders, 8" wheel, pedestal type, with safety eyeshields	NA	E	24"x18"x48"	1	208	3		D						
	1	Grinder, carbide tool, pedestal type, with safety eyeshields, Baldor	$1,450.00	M	24"x18"x48"	1/2	208	3		D						

ALGER, DOWLING, PAULLIN, INC.
P.O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Manufacturing Process/CNC Lab, cont. ROOM NO.: REVISIONS

DRAWING NO.: ORIGINATION DATE:

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL					MECHANICAL					COMMENTS:
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.	
	1	Grinder, die type, port., electric, with attachments	$670.00	M												
	2	Surface Plate, bench mtd., 8" x 12" to 18" x 24", with base	$300.00	M												
	1	Surface Plate, floor standing, 36" x 36" with stand	$450.00	M												
		OTHER:														
	1	Press, hydraulic, floor standing, 20 ton cap.	NA	E			NA									
	1	Saw, cut-off type, horizontal, band, floor standing, portable, Wells	NA	E	72" x 24"	1	208	3		D						
	1	Saw, vertical band type, floor standing, contour cutting, with hydraulic table and blade welder	$8,900.00	M	53" x 61"	3	208	3		D						
	1	MIG Welder, Linde 225	NA	E	20"x37-1/2" x32"		208	1	52	D						
	1	Arc Welder, 225 amp, Lincoln AC225-S	NA	E			208	1	50	D						
	1	Welding and Cutting Outfit, oxygen/ acetylene, with cylinder cart, port.	NA	E												
	3	Table, welding, floor standing, with firebrick surface, GMI #GT-2	$1,440.00	M	30"x25"x43"							X				Exhaust per code

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ALGER, DOWLING, PAULLIN, INC.
P.O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Manufacturing Process/CNC Lab, cont. ROOM NO.: REVISIONS

DRAWING NO.: ORIGINATION DATE:

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL					MECHANICAL					COMMENTS:
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.	
	1	Furnace, dual heat treat type, hardening, annealing, stress relieving, floor standing, 2300 degrees temp., electric with safety control, McEnglevan #DH820	$2,100.00	M	36" x 46"	1/3	208	3	*	D		X				*14KW; Vent per code
	1	Tank, quench, port., ten gallon water cap.	$380.00	M												
	1	Forge Furnace, Black	NA	E												Elec./Mech. Info to follow
	1	Vacuum, wet/dry, shop type, heavy duty, with accessories	$650.00	M			120	1	*	C						*750 Watts
	1	Cabinet, safety glass, with glasses, wall mtd., with lens cleaner	$720.00	M			120	1	1	C						52" A.F.F.
	2	Cans, oily waste type, 10 gallon cap.	$88.00	M												
	2	Cans, solvent, safety type, 3 gallon cap.	$100.00	M												
	2	Cabinet, flammable materials storage, floor standing	$1,600.00	M												Vent per code
	1	Cabinet, tool storage, for machine shop hand and power tools	$250.00	M												
	1	Cabinet, tool storage, for layout and inspection tools	$250.00	M												

ALGER, DOWLING, PAULLIN, INC.
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PROGRAM: Manufacturing Process/CNC Lab, cont.
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ROOM NO.:
ORIGINATION DATE:

REVISIONS

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL						MECHANICAL					COMMENTS:
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.		
	6	Cabinet, storage, steel, double locking doors	$1,500.00	M													
	12LF	Shelving, storage type, heavy duty, for machine accessories	$3,000.00	M													
	9LF	Storage Unit, bin type, heavy duty, for machine accessories and tooling	$750.00	M													
	9LF	Storage Unit, drawer type, heavy duty, for machine accessories and tooling	$750.00	M													
	16LF	Rack, steel storage, for steel bar storage, floor standing or wall mtd.	$1,400.00	M													
	6	Cart, tool, port., with drawers for machine accessories and tooling	$636.00	M													
	1	Cart, platform, port., material handling	$465.00	M													
	1	Truck, hand, drum type, 500 lb. cap.	$65.00	M													
	8	Bench, machine shop type	$1,000.00	M/E	2' x 4'												(4) Existing
	2	Bench, layout type, with storage shelves	$3,400.00	M													
	1	Desk, shop, instructor's, with drawer storage	$225.00	M													

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ALGER, DOWLING, PAULLIN, INC.
P.O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Manufacturing Process/CNC Lab, cont. ROOM NO.: REVISIONS

DRAWING NO.: ORIGINATION DATE:

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL					MECHANICAL					COMMENTS:
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.	
	1	Stool, instructor's, with padded seat and backrest	$150.00	M												
	8	Vise, machinist, swivel base, for bench mounting	$1,600.00	M												
	1	Anvil, 200 lb., with floor stand	NA	E												
	1	Optical Comparitor, floor standing, 14" size	$5,200.00	M	18"x48"x56"		120	1	3	C						
	1	Universal Tester, compression type, Tinius Olsen	NA	E	72"x20"x72"											2,600 lbs.; Elec./ mech. info to follow
	1	Torsion Test Unit, Tinius Olsen	NA	E												Elec./mech. info to follow
	1	Impact Tester, Tinius Olsen	NA	E			NA									
	1	Dry Blast Cleaning Unit, Blast All #4426-F	NA	E	48"x30"x60"	1	208	3		D	X					100 PSI; Access doors each end; 56 CFM
	1	Surface Grinder, automotive type, Kwik-way #860T	NA	E	97"x44"x64"	9-1/2	208	3		D						4,120 lbs.
	1	Tumble Cleaner, floor standing, crank shaft size, Model AXE-TC-1	NA	E	20"x31"x31"	1/4	120	1		C						
	1	Pressure Tester, Ironrite 78000	NA	E	42"x24"x36"/ 24"x24"x18"	1	208	3		D	X					100 PSI; 6 CFM

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ALGER, DOWLING, PAULLIN, INC.
P. O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Manufacturing Process/CNC Lab, cont. ROOM NO.:

REVISIONS

DRAWING NO.:

ORIGINATION DATE:

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL					MECHANICAL					COMMENTS:
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.	
	1	Crank Shaft Grinder, 85" to center, Schoo	$70,950.00	M	165"x72"x63"	12	208	3		D						240" F.S. required; 10,890 lbs.
	1	Cylinder Honing Machine, Serve Equip. #SE2300	NA	E	40"x30"x35"	1/2	120	1		C						2 CFM
	1	Cylinder Boring Fixture, Kwikway #048	NA	E	55"x33"x35"	NA										
	1	Head Shop Machine, Kwikway #041	NA	E	70"x30"x93"	1-1/2	208	3		D						2,130 lbs.
	4	Engine Stands, port., heavy duty	$10,500.00	M												
	1	Magnaflux Unit, Kwikway #MPI259	$14,410.00	M	120"x30"x36"		208	3	*	D						*100 Amps; 1,750 lbs.
	1	Wet Seat Grinder with stones and arbor, Kwikway #039/S8H/I	$2,570.00	M												
	1	Rod & Pin Honing Machine, Kwikway #085/ Delapena	$18,000.00	M	36"x30"x42"	1	208	3		D						
	1	Crank Shaft Polisher, Kwikway #141, port.	$550.00	M		1/2	120	1		C						
	1	Crank Straightener, Kwikway #533	$2,220.00	M	72"x30"x48"	NA										

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ALGER, DOWLING, PAULLIN, INC.
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GRAND RAPIDS, MI 49501

PROGRAM: Manufacturing Process/CNC Lab, cont. ROOM NO.: REVISIONS

DRAWING NO.: ORIGINATION DATE:

ITEM NO.	QTY.	DESCRIPTION	COST	M/F/E	SIZE L x W x H	ELECTRICAL					MECHANICAL					COMMENTS:
						H.P.	VOLTAGE	PHASE	AMPS	CONN. C/D	AIR	EXHAUST	GAS	WATER	FL. DR.	
	1	Valve Grinder, face and seat, floor standing, with accessories	NA	E		1	120	1		C						
		FIXED TOTAL	$300.00													
		MOVABLE TOTAL	$292,689.00													
		GRAND TOTAL	$292,989.00													

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SECTION VI

ATTACHMENTS

Citizens' Voice, Wilkes-Barre, Pa. Wednesday, September 17, 1986 — 4B

LCCC, area vo-techs plan technologies programs

LCCC and vo-tech school representatives meet in joint session

Representatives from five area vocational-technical schools met recently with officials at Luzerne County Community College for the purpose of beginning the joint planning for development of curriculum materials for several new advanced technology programs.

Among the area vo-tech schools represented at the meeting, held at the school's Educational Conference Center, were Hazleton, Lackawanna, Susquehanna, West Side and Wilkes-Barre. The curricular programs involved in the project include Computer Integrated Manufacturing, Computer Repair Technology, Laser/Electro-Optics, Computer Assisted Design and Robotics/Automated Systems.

The project between the community college and technical schools is designed to develop competency-based curricula which a student can begin at the secondary or vocational-technical school level and continue at the post-secondary or college level without an interruption in studies.

Among those in attendance for the meeting, first row, from left, were: James Newell and Edward A. Shedlock, Wilkes-Barre AVTS; Gray Bond; Henry Stachura and James Davis, Lackawanna County AVTS; Joseph Zmitrovich, Hazleton AVTS, and James Kane and David Lyons, West Side AVTS; second row: Wesley E. Franklin, director of business/industry/education partnership at LCCC; Ben Rondomanski, Lackawanna AVTS; James Haggerty, Wilkes-Barre AVTS; Walter Rounds and Paul Liptay, Lackawanna AVTS; Linda M. Thomas, educational programmer at LCCC; Jo Anne Sabalske, video producer, LCCC, and Bill Karloltski, production engineer at LCCC; third row: Nathan Williams, Wilkes-Barre AVTS; Carol Adukaitis, Susquehanna AVTS; Dominic Pino, John Lenchak, Nicholas St. Maray, Hazleton AVTS; GFene Frick and Joseph Kasztejna, Lackawanna AVTSS; Ormond Loing, Wilkes-Barre AVTS; Libby Yeager, research specialist at LCCC; Regina Antonini, director of special services p;rogram at LCCC, and Kenneth G. Kirk, Pennsylvania Department of Education.

One of the main purposes of the joint planning effort, approved by the Pennsylvania Department of Education, Bureau of Vocational and Adult Education, with funding from the Perkins Vocational Education Act of 1984, is to develop competency-based curricula. LCCC would develop programs so high school graduates without a technology background could also enroll in them.

Coordinating the project at LCCC is Wesley E. Franklin. Said Franklin, "This represents a major collaboration between the five technical schools and LCCC, establishing a model for joint planning between secondary and post-secondary educational institutions in the development of what is known as the '2 + '2 concept. This concept provides for instructional continuity between the first two years of a program offered at the secondary level and the next two years at the community college."

Recognizedd by the Pennsylvania Department of Education, Bureau of Vocational Education, as a unique, innovative approach, this synergistic effort will help to eliminate duplication of expensive advanced technology equipment, maximize the instructional resources of all participating institutions, and open new or expand existing channels of communication and cooperation between the vocational technical schools and LCCC.

"The directors of each vocational technical school were instrumental in the development of the project and provided essential impetus in involving members of their staffs," noted Franklin. "The project will also draw heavily on the expertise of local business and industry in establishing what technological tasks should be included in each program and what level of competency is acceptable for each."

Franklin concluded: "One of the primary reasons for creating such a project was the emphasis of the Pennsylvania Department of Education on program development in advanced technologies, supported by the very strong indicators in economic and industry data that the technologies included will be essential components of Northeastern Pennsylvania's future labor force."

For further information on the project, contact Franklin at 829-7380, or Nancy Kosteleba, director of the Center for Instructional Development at LCCC, at 829-7355.

AUTOMATED SYSTEMS/ROBOTICS AND COMPUTER ASSISTED/COMPUTER INTEGRATED MANUFACTURING

LITERATURE SEARCH

Automated Systems Technology (March 1986)	North Iowa Area Community College 500 College Drive Mason City, IA 50401
Robotics/Automated Systems Technician Training (1985)	Center for Occupational Research and Development 601C Lake Air Drive Waco, TX 76710
Electromechanical Drafting	Idaho State University School of Vocational-Technical Education Pocatello, ID 83209-0089
CAD/CAM CIM	Camden County College P.O. Box 200 Blackwood, NJ 08012
Automation/Robotics Technology	Catawba Valley Technical College Hickory, NC 28601
Fundamentals of Industrial Robotics - Video Tape Teacher's Guide	Meridian Education Corporation 205 East Locust Street Bloomington, IL 61701
Electronics Diagnostic Technician	Hawkeye Institute of Technology 1501 East Orange Road Waterloo, IA 50704
A Catalog of Performance Objectives and Performance Guides for Electromechanical (Robotics) Technician (Copyright 1984 V-Tec)	Associated Educational Consultants, Inc. Pittsburg, PA 15237 and Pennsylvania Department of Education Harrisburg, PA 17108

Preparing for High Technology CAD/CAM Programs A Guide for Community Colleges Robotics Program	The National Center for Research in Vocational Education The Ohio State University 1960 Kenny Road Columbus, OH 43210
Computer-Aided Drafting and Design	York College York, PA
Hydraulic Technician Industrial Pneumatic Technology	State Department of Vocational and Technical Education CIMC Stillwater, OK
Robotics Training Systems Concepts and Applications	Buck Engineering Company for Lab-Volt
Professional Teacher Education Module Develop Program Goals and Objectives Conduct an Occupational Analysis Develop a Course of Study Develop Long-Range Program Plans	American Association for Vocational Instructional Materials The University of Georgia Athens, GA 30602

DIRECTIONS:

RATE EACH TASK ON A SCALE OF 1 TO 5 WITH 1 - LEAST IMPORTANT AND 5 - MOST IMPORTANT.

A - Electrical/Electronic

1. Use manufacturers' parts list and drawings concerning replacement parts for Robotics/Automated Systems to

   3.63 a. Identify part numbers
   2.13 b. Order replacement parts
   3.38 c. Install replacement parts

2. Adjust, troubleshoot, repair, and/or replace:

   3.63 a. Power supplies
   3.25 b. Servo amplifiers
   3.38 c. Motor control circuits
   3.38 d. Electronic sensors
   3.13 e. Transducers

2.50 3. Attach and replace connectors to wire and fiber optic cables.

2.38 4. Install low and high voltage and interconnecting signal (wire and fiber optic) cables.

2.63 5. Troubleshoot and repair wire and fiber optic system cable faults.

3.38 6. Conduct routine preventive maintenance on electrical and electronic equipment in accordance with manufacturer's recommendations.

3.38 7. Troubleshoot electronic failures to the circuit board level; replace defective circuit board.

2.50 8. Conduct routine preventive maintenance on AC and DC motors in accordance with manufacturer's recommendations.

9. Install, adjust, troubleshoot and repair or replace to manufacturer's specification:

   3.50 a. Control devices
   2.88 b. Relays (electromechanical and solid state)

3.50 c. Sensors
3.25 d. Limit switchers
3.25 e. Transducers
3.63 f. 1 and 3 electrical equipment

2.50 10. Connect fiber-optic cables to electronic equipment.

3.25 11. Troubleshoot and repair or replace fiber optic components/systems.

3.63 12. Program stepper motors.

3.13 13. Apply bridge circuits to measuring voltages and currents.

3.00 14. Replace components on circuit boards.

3.25 15. Solder and desolder electrical connections.

2.88 16. Install and remove circular (multipin), coaxial, and in-line plugs and receptacles.

17. Measure and set voltages and currents.

2.75 a. Facility power
3.25 b. Equipment power supply

B - Pneumatic

3.13 1. Maintain pressure regulators.

2. Install, adjust troubleshoot and repair or replace pneumatic:

2.88 a. Airlines
3.38 b. Pumps
3.00 c. Gages
3.25 d. Filters
3.75 e. Control valves
3.50 f. Actuators
3.25 g. Cylinders
3.63 h. Pressure switches
3.63 i. Positioner relays

3.38 3. Adjust a pneumatic-sensor temperature controller to a specified mixed air temperature.

3.50 4. Properly use dampers, thermostats, switches, pneumatic positioners, linkage assemblies and accessories in pneumatic systems.

3.13 5. Conduct routine preventive maintenance on pneumatic equipment in accordance with manufacturer's instructions.

C - Hydraulic

1. Install, adjust, troubleshoot, and repair or replace hydraulic:

3.13 a. Lines
3.38 b. Pumps
3.13 c. Gages
3.63 d. Filters
3.25 e. Accumulators
3.50 f. Volume controls
3.63 g. Servo valves
3.38 h. Directional control valves
3.25 i. Pressure control valves

3.00 2. Test for hydraulic oil quality and use external filter system to purify.

3.50 3. Control oil pressure and temperatures.

3.63 4. Null hydraulic system pressure losses.

3.63 5. Conduct routine preventive maintenance on hydraulic equipment in accordance with manufacturer's specifications.

D - Mechanical

3.75 1. Set and adjust mechanical stops.

4.00 2. Set actuators to proper end positions.

3.63 3. Install and maintain linkage.

3.25 4. Install and maintain gear trains.

3.13 5. Conduct routine preventive maintenance on mechanical equipment in accordance with manufacturer's specifications.

E - Computer

3.00 1. Troubleshoot malfuctions in computer system to circuit board level.

2. Install, troubleshoot, remove and replace:

3.13 a. Memory devices
3.13 b. Displays
3.38 c. Control circuits
3.25 d. Keyboards and printers
3.63 e. Central processing unit (CPU)

3. Install input/output (I/O) devices in accordance with manufacturer's specifications:

3.25 a. Cathode-ray tubes (CRTs)
3.13 b. Printers
3.00 c. Tape drives
3.00 d. Disk drives
3.13 e. Plotters
3.00 f. Flat screen displays (including gas plasma displays)

3.13 4. Install module or board-mounted RAM and ROM memory devices in accordance with manufacturer's specifications.

4.00 5. Load and run diagnostic routines.

3.88 6. Interpret diagnostic printouts.

4.38 7. Install programmable controllers.

2.75 8. Use diagnostic routine program language written in machine language(s).

9. Program and/or reprogram PCs (drum, relay, and microprocessor types) for specific sequence of events in performing an application.

3.38 a. Prepare a flow chart for a specific sequence of events in performing given application.

3.88 b. Enter instructions into control unit.
3.75 c. Run program to see if control unit executes properly.

4.00 d. Edit or debug program as necessary.
4.00 e. Download and upload system.
3.75 f. Recognize and resolve hardware/software impedance matching problems.

3.75 10. Write, enter, and debug programs in one structered language.

3.25 11. Install, set up, calibrate, troubleshoot and repair or replace data transmissions systems.

F - Electromechanical

1. Install, adjust, troubleshoot and repair or replace:

3.75 a. Servo motors
3.25 b. AC pump motors (vacuum and pressure)
3.00 c. Speed-reduction units
3.00 d. Clutches
3.88 e. Stepping motors
3.38 f. Mechanical drives for feedback system

2. Install, adjust, troubleshoot and repair or replace sensors for:

3.50 a. Flow control
3.38 b. Liquid-level control
3.75 c. Ultrasonic control
3.50 d. Optoelectric
3.13 e. Tactile
3.38 f. Video

G - General

3.75 1. Effectively select and utilize such test equipment as time-domain reflectometers, oscilloscopes, spectrum analyzers, function generators, chart recorders, and multimeters for troubleshooting and repair of electronic circuits.

3.38 2. Identify and demonstrate proper operation, care and maintenance of hand power tools.

3.25 3. Select and install the proper fastener for a given job.

3.50 4. Identify and use appropriate lubricant.

4.00 5. Use manual's troubleshooting charts to aid fault isolation/repair.

3.75 6. Maintain work log sheets.

3.63 7. Draw logic diagrams.

3.75 8. Read, understand and comply with requirements of service bulletins.

3.25 9. Convert measurements between English and SI systems.

3.63 10. Use both inside and outside micrometers.

4.13 11. Use manufacturer's manuals as a guide to troubleshoot, repair, test and operate a failed machine.

4.13 12. Use manufacturer's manuals to determine a machine's normal operating characteristics.

4.00 13. Using a manual, identify operational/functional systems.

H - Automated Systems

2.88 1. Measure robot performance (distance, positioning, accuracy, and repeatability).

2.88 2. Use teaching pendant for testing, editing and setup.

3.00 3. Disassemble, repair, test and return to service robots which have failed.

4. Install, adjust, troubleshoot, repair or replace:

3.50 a. Industrial robots
3.00 b. End effectors
3.50 c. Smart actuators

3.50 5. Coordinate the operation of several pieces of automatic equipment.

6. Adjust feedback loops that include:

3.63	a.	Encoders/decoders
3.63	b.	Optical sensors
3.63	c.	Electronic sensors
4.00	d.	Microprocessor
3.75	e.	Count stepper-motor pulses
3.25	f.	Optoelectronics
3.25	g.	Hall-effect devices
3.25	h.	Velocity sensors
3.63	i.	Position detectors

3.50 7. Interconnect robots and other equipment.

3.63 8. Adjust machines for accuracy and repeatability.

3.00 9. Set up machine vision systems.

4.00 10. Match off-the-shelf and effectors to the requirements of various manufacturing operations.

3.63 11. Analyze robot task requirements of a manufacturing operation.

3.50 12. Analyze and select appropriate robot sensing requirements for certain manufacturing operations.

4.00 13. Start-up and debug a robot system.

3.88 14. Start-up and shut down an automated production systems.

4.00 15. Specify safety considerations for personnel, work area, operations, and maintenance.

3.63 16. Test wiring of each subassembly of a robot; test the overall, connected wiring of the total robot.

4.50 17. Install a programmable controller and its input/output devices.

4.00 18. Follow troubleshooting procedures recommended by the manufacturer to diagnose, isolate and repair a robot/automated system.

3.88 19. Analyze operating difficulties of installed robots; perform necessary corrective adjustments to return system to normal operation.

3.25 20. Perform field testing of a robot and chect to assure that its peformance is in accordance with specifications.

3.13 21. Perform electrical adjustments on servo power amplifiers.

3.13 22. Perform zeroing of encoders.

3.50 23. Specify the robot coordinate system.

3.63 24. Develop material handling specifications for a work cell.

3.38 25. Specify the robot-to-material interfaces.

3.25 26. Define the human interface with a robot.

3.38 27. Define axis control and feedback specifications.

3.50 28. Set up, program, troubleshoot a system comprised of a minimum of two transfer lines, one robot, and at least one machining center.

3.63 29. Set up, etc., robot to either remove parts from transfer line and palletize them or to depalletize parts and place them on a transfer line.

30. Given the above setups, the instructor will install a programming error. The student (team) will diagnose and correct the problem and test the solution.

3.50 a. Programming
3.13 b. Mechanical stops
3.25 c. Electrical
3.38 d. Hydraulic power supply

3.25 31. Set up a robot to either paint parts on a moving line or weld parts on a moving line (line will stop for welding cycle).

32. Set up, etc., a robot to assemble two parts--use at least three fasteners:

3.38 a. Index
3.15 (7) b. RCC
2.75 (8)

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32. Set up, etc., a robot to assemble two parts--use at least three fasteners:

3.38 a. Index
3.15 (7) b. RCC
2.75 (8)

3.38 c. Pick up
3.00 d. Fasteners
3.25 e. Install parts

3.25 33. Configure a system for counting regular/irregular shaped objects moving on an overhead track.

2.72(7) 2.38(8) 34. Define signal-sensing-control and poser interfaces involved in the first two problems.

35. Operate the following equipment:

3.25 a. End effectors
3.38 b. Grippers
3.00 c. Magnetic pickups
2.75 d. Vacuum pickups
2.75 e. Compliance devices

36. Adapt the following to robotic application:

2.75 a. Welder
2.50 b. Adhesive applicators
2.75 c. Paint sprayers
2.00 d. Grinders

37. Adapt the following to work with automated systmes:

2.75 a. Conveyors
2.38 b. Bulk feeders

38. Set up, operate, troubleshoot, and repair automated:

3.00 a. Warehousing systems
3.75 b. Machinery operations
3.00 c. Coating/application systems
3.75 d. Assembling stations
3.63 e. Material handling systems

2.88 39. Program a host computer to control several "lower-level" computers that in turn control portions of an automated system.

I - Design

3.25 1. Create two-dimensional drawing using the graphics terminal, digitizer, and plotter as design and drafting tool.

3.13 2. Sketch views not shown in a drawing.

SECTION VII

SAMPLE TASK FORCE LETTERS

HAZLETON AREA VOCATIONAL-TECHNICAL SCHOOL

23rd & McKinley Streets
Hazleton, Pa. 18201-1597

DANIEL C. PARRELL
Superintendent of Schools

DALE H. LONG
Director

June 18, 1987

Mr. Wesley E. Franklin
Director, BIE Partnership
Luzerne County Community College
Prospect Street and Middle Road
Nanticoke, PA 18634

Dear Mr. Franklin:

My involvement with the C.I.M. Task Force has been an enjoyable one. It is very pleasing to know that the Luzerne County Community College is making a very positive effort to bring a taste of Advanced Technology to the area.

I have been involved with High-Tech Manufacturing for the last nine years and I can see the need for well trained High-Tech people.

I feel that we have put forth a very well-balanced Competency-Based curriculum. All of the materials were gone over again and again in order to maintain the best possible course of study.

The meetings along with the educational trips were most important in order to meet our goal.

I would feel honored to be involved with the Advanced Technology Center in any way, whether it be in curriculum development, as a machine purchasing consultant, or on the instructional end.

Finally the people who were in charge of each committee acted in a very hospitable, professional manner.

Hope to see you in the fall.

Yours truly,

Leonard J. Tarapchak

Leonard J. Tarapchak

LACKAWANNA COUNTY AREA VOCATIONAL-TECHNICAL SCHOOL

CHARLES G THOMAS
Assistant Director

Dr. Peter M. Mansky Center
Old Plank Road
Mayfield, Pennsylvania 18433

282-8780 or 876-4081

ROBERT D MUZZI
Administrative Director
3201 Rockwell Avenue
Scranton, Pennsylvania 18508
(717) 346-5855

ARTHUR M LUCARELLI
Assistant Director

Henry J. Dando Center
3201 Rockwell Avenue
Scranton, Pennsylvania 18508

Main Office 346-8471
Practical Nursing 346-8726

June 16, 1987

Mr. Wesley E. Franklin
Luzerne County Community College
Prospect and Middle Road
Nanticoke, Pa. 18634

Re: Robotics/Automated System Task Force

Dear Wes:

I would like to express my thanks for letting me be a part of your task force. I hoped my participation helped you meet your goals. In my opinion we came a long way.

After we got past the preliminaries concerning CBE definitions and activities we had solid direction for our own activities. I must commend Libby on her thorough research of related materials and the timely presentation of same. The material was very appropriate and certainly not lacking in quantity. Libby did an excellent job on the competency verification. The visit to Lancaster Vo-Tech and Harrisburg Community College along with Dave Rohm's presentation was extremely helpful as it related to equipment needs, interactive problems between the two institutions and problems related to the academic section.

We are at a point now where specific goals can be established within a determined time line. Meetings should be held to meet these goals which at this time could be more often than in the past.

I will be glad to participate next year if the need arises. The project which included needs determination and curriculum content certainly is required before program implementation. There certainly is a need for continuation of this project.

I would like to add the following comments and/or suggestions:

1. The 2 + 2 concept sounded good initially, however, as time went on it became obvious it is not practical at L.C.C.C. or A.V.T.S. level.

2. The task force is at a point where Dr. McQuay's work is required. Emphasis should be placed on his completing the draft copy of the entire curriculum.

3. The establishing of new course(s) should be considered. Assuming a course can automatically apply to a program is not accurate.

Example: Why does a robotics technician need to have knowledge of drafting techniques and occupations when a Sketching/Blueprint Reading Course will suffice? The depth of the Industrial Process courses is also questionable.

4. L.C.C.C. and the A.V.T.S. should develop a joint effort to change the image of vocational education. This I know influences your enrollments as well as ours. Prime target should be guidance staff.

Again I thank you for the opportunity to have input.

Sincerely,

Ben Rondomanski

Ben Rondomanski
Supervisor of Voc. Ed.

BR/cn
cc: E. Yeager

West Side Area Vocational-Technical School

75 EVANS STREET
PRINGLE BOROUGH
KINGSTON, PENNSYLVANIA 18704-1899
PHONE: 717-288-8493

Member School Districts:
NORTHWEST AREA
LAKE-LEHMAN
DALLAS
WYOMING AREA
WYOMING VALLEY WEST
And Services to:
GREATER WILKES-BARRE AREA

Administrative Director
GEORGE W. PYLE
Principal
THOMAS F. FEENEY
Business Manager
BRUCE W. GERMAAN
Data Processing Services Manager
ROBERT D. POWELL

June 10, 1987

Mr. Wesley E. Franklin
Curriculum Materials Development Task Force
Luzerne County Community College
Prospect & Middle Roads
Nanticoke, PA 18643

Dear Wes:

I understand you will be writing the final report soon on "our" project. What a good idea to get input from area vocational-technical high school teachers before setting up your new technology center. Who is better able to tell you what is needed in regard to classrooms, equipment, shops, students, courses, etc. Hopefully, I have been of some help. I also think it was a good idea to visit vocational-technical schools in other areas of the state to see how they were coping with the new technologies.

Northeastern Pennsylvania needs this center badly. We need it to induce new industry to our area, so our young people don't have to leave to find a decent job. We in the vocational high schools need it to induce college-bound students to attend our school, to help dispel the myth that vocational students don't go to college.

Please contact me if I can be of any further assistance. The success of this center is important; not only to the college but to all of us who live in this area.

Sincerely yours,

Kathy Heltzel

Kathy M. Heltzel, Instructor
Data Processing

KMH/kk

*"He who hath a trade, hath an estate"**

** Attributed to Benjamin Franklin*

WILKES-BARRE AREA VOCATIONAL-TECHNICAL SCHOOL

P.O. Box 1699 North End Station
Jumper Road, R.D. 2 Plains Township
Wilkes-Barre, Pennsylvania 18705
[717] 822-4131

GEORGE T. YANIK, CHAIRMAN
JOINT OPERATING COMMITTEE

ROBERT G. ELIAS
ADMINISTRATIVE DIRECTOR

LEO E. SOLOMON
CHIEF SCHOOL ADMINISTRATOR

June 10, 1987

Mr. Wes Franklin
Luzerne Community College
Nanticoke, Pa. 18634

Dear Sir,

It has indeed been a pleasure to serve on your Curriculum Committee for the new High Tech Center which is being constructed at the college.

The materials covered were extensive, well prepared and presented in a manner which was in the best of everyone's interest.

The days and times of the meetings were always agreed to so that everyone could attend without any hardships incurred.

I believe much was accomplished and look forward to more productive meetings in the future.

Yours Truly,

Al Grabowski,
Wilkes-Barre Area Vo-Tech
Adult Evening Coordinator